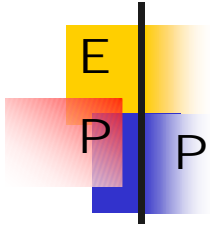


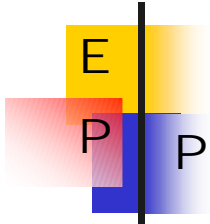
Toward a FUTURE Program



~~Elementary~~ EXPEDITIONS with Particle Physics

HEPAP
JULY, 2003
Marv Goldberg





We can learn from the expedition of :



<http://www.pbs.org/lewisandclark/>

Unknown

SELECTIONS

On their maps, the land that Lewis and Clark were headed toward was indicated by a vast, blank space and the word, **"Unknown."**

Knowing there would be skeptics, especially among his foes in the Federalist party, Jefferson worded his message in a way that minimized military risks and used commercial gains as the bait. He made the temptation cheap, **asking only \$2,500 to fund the expedition.**



Actual costs reached \$38,722.

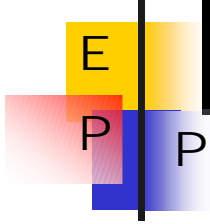
To Equip an Expedition

- Barton's Elements of Botany
- Antoine Simon Le Page du Pratz's History of Louisiana
- Richard Kirwan's Elements of Mineralogy
- A Practical Introduction to Spherics and Nautical Astronomy
- The Nautical Almanac and Astronomical Ephemeris
- A two-volume edition of Linnaeus (the founder of the Latin classification of plants)
- Tables for finding longitude and latitude
- compass; quadrants ; telescope
- thermometers ; sextants
- set of plotting instruments
- chronometer (needed to calculate longitude) ; map of the Great Bend of the Missouri River



11/28/2003

MG HEPAP JULY 2003



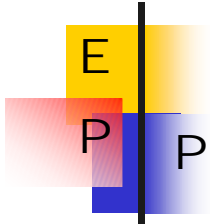
So, I think the number one human lesson of the Lewis and Clark expedition is what can be accomplished by a team dedicated to a common purpose.

The Lewis and Clark journey is so accessible. We can all get on board. We can be members of the Corps of Discovery. We can slip our own lives into their lives and then we can make the journey with them. A journey of wonder and excitement... It has, like few other stories, a place for all of us. All of us want to find a place in story. And this is one of those stories that reaches out and says, there is a place in this story for you.

Can we plan our future expedition from Quarks to the Cosmos as members of a Corps of Discovery?

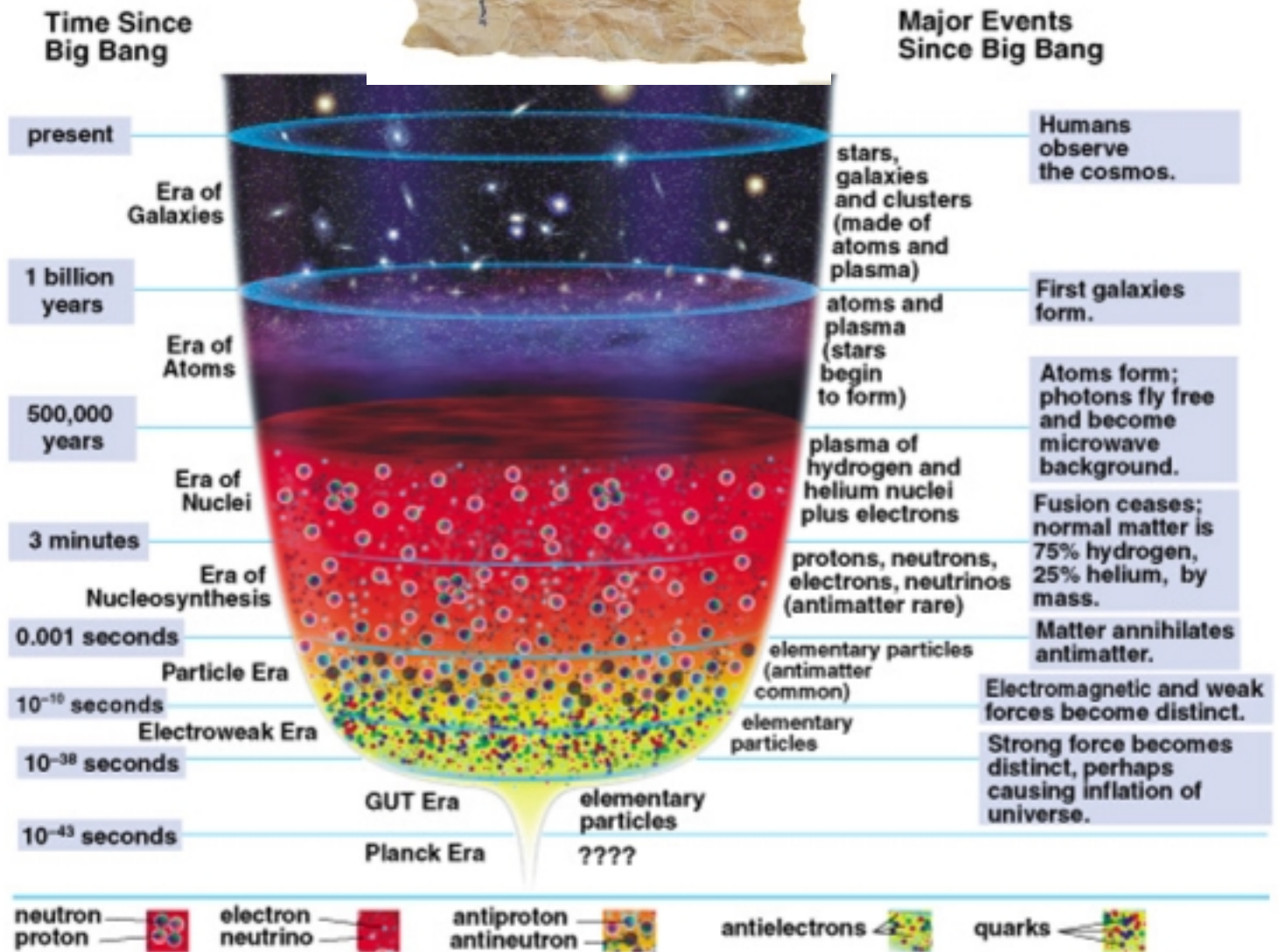
To Equip an Expedition

Unknown



QUARKS TO THE COSMOS (Q2C)

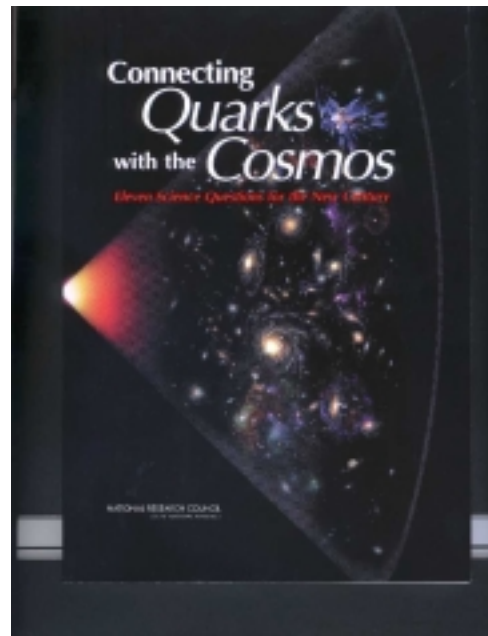
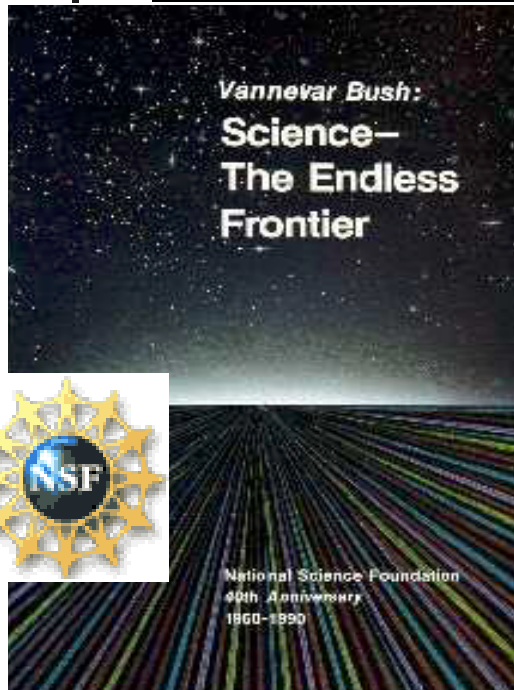
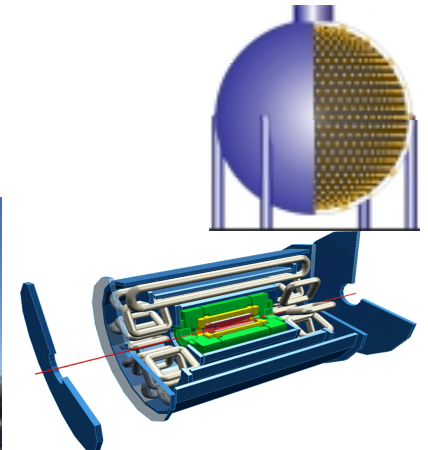
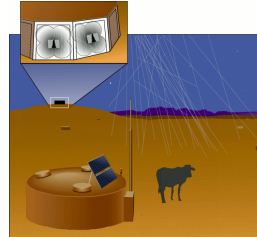
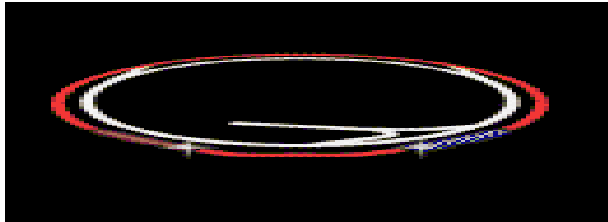
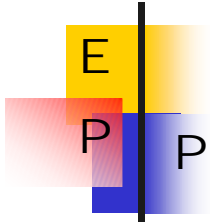
Antimatter?:
Dark matter?
Dark energy?
Masses (Higgs)?;
Mixings?;
Supersymmetry?
Unification?
More Dimensions?
Gravity?



7/28/2003

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To Equip an Expedition To The Endless Frontier



<http://www.nsf.gov/od/lpa/nsf50/vbush1945.htm>

http://doe-hep.hep.net/lrp_panel/



2003

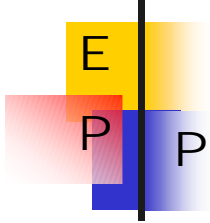
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NEW-Trillium



To Equip an Expedition

PHY/NSF TRANSFORMATION BY ADDING MAJOR EXPERIMENTS



FY 04 **MREFC** (>\$100M) Related Funding Requests:

- LHC Research;
- RSVP Construction;
- ICECUBE Construction

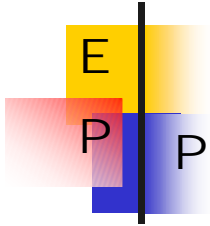
Planning funds

- Underground Laboratory
- Linear Collider

Mark Coles

Deputy
Director -
Large
Facility
Projects

To Equip an Expedition



PHY/NSF TRANSFORMATION BY ADDING PROGRAMS

FY 02: Particle Astrophysics
FY 02 Physics Frontier Centers

FY 04: Accelerator Program:
Enhancing Accelerator Science at
universities *and its Impact on*
Other Sciences.

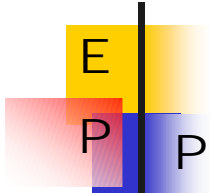
**FY 04: Physics at the Information
Frontier Program :** Computational
physics, information intensive physics,
and quantum information and
revolutionary computing.

**Michael S.
Turner**
of the
University of
Chicago-

Assistant
Director for
Mathematical
and Physical
Sciences

To Equip an Expedition

TRANSFORMATION BY NEW **FUNDING MECHANISMS**



National Science Board

<http://www.nsf.gov/nsb/documents/2003/start.htm>

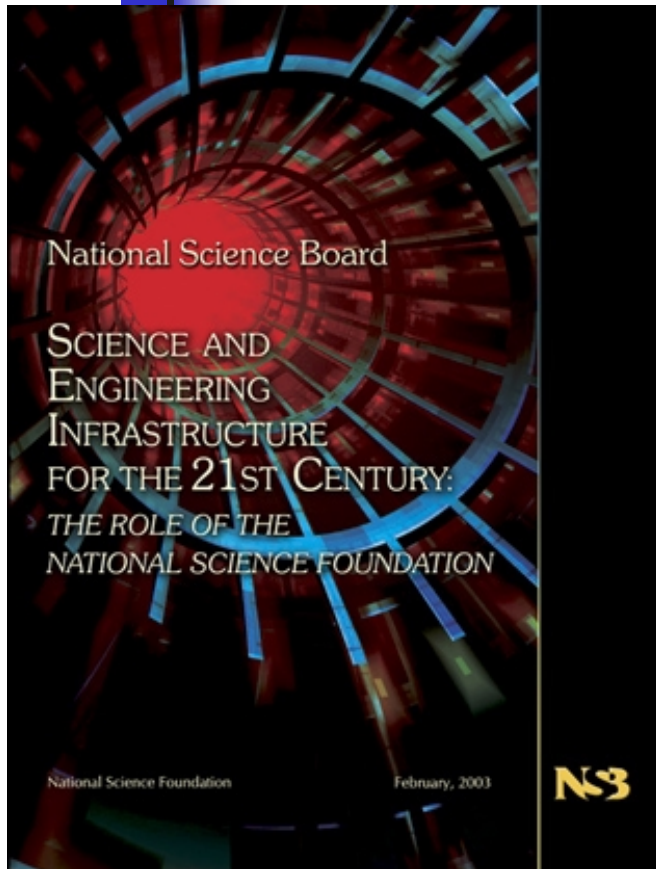
THE MRI -MREFC FUNDING GAP (\$2M-\$100M)

**ADDRESS THE INCREASED NEED
FOR MIDSIZE INFRASTRUCTURE.**

develop new funding mechanisms,
as appropriate, to support midsize
projects.

AND MORE

We should know more soon



To Equip an Expedition

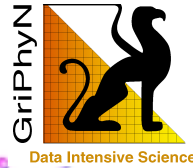
TRANSFORMATION BY NEW **PARTNERS**

(doubling of funds available).

PHY/MPS and

CISE

EHR

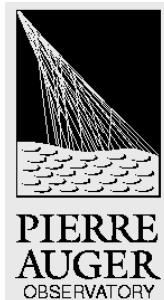


◀ DOE ; CROP, ASPIRE

(all of us can find a place...)

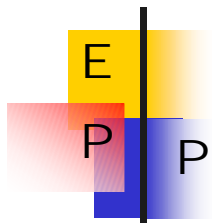
INT Physics *Emasondosondo* "Physics-on-the-move" in Africa.

Science/
AST



VERITAS With DOE
Very Energetic Radiation
Imaging Telescope Array System

Building on Existing Partnerships



Report of the National Science Foundation Blue Ribbon Advisory Panel on Cyberinfrastructure

<http://www.cise.nsf.gov/evnt/reports/toc.htm>

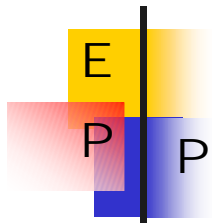
Executive Summary Excerpt

...cyberinfrastructure is a key to making this possible.... A few examples are the Network for Earthquake Engineering Simulations (NEES), the Space Physics and Aeronomy Research Collaboratory (SPARC), the National Ecological Observatory Network (NEON), the Grid Physics Network (**GriPhyN**), the International Virtual Data Grid Laboratory (**iVDGL**), and the **High Energy Physics Collaboratory** for the ATLAS project.

The Panel's overarching recommendation is that the National Science Foundation should establish and lead a large-scale, interagency, and internationally coordinated Advanced Cyberinfrastructure Program (ACP) to create, deploy, and apply cyberinfrastructure in ways that radically empower all scientific and engineering research and allied education.

THE LHC AND CYBERINFRASTRUCTURE

<http://lcg.web.cern.ch/LCG/default.htm>



LHC Computing Grid Project The world's largest and most powerful particle accelerator, the Large Hadron Collider (LHC), is being constructed at CERN, the European Organization for Nuclear Research, near Geneva on the border between France and Switzerland.

The accelerator will start operation in 2007 and will be used to answer the most fundamental questions of science by some 6,000 people from universities and laboratories all around the world. The computational requirements of the experiments that will use the LHC are enormous: 12-14 PetaBytes of data will be generated each year, the equivalent of more than 20 million CDs. Analysing this will require the equivalent of 70,000 of today's fastest PC processors.

The goal is to meet these unprecedented computing needs by deploying a worldwide computational grid service, integrating the capacity of scientific computing centres spread across Europe, America and Asia into a virtual computing organisation.

DEVELOPING A GLOBAL INTERAGENCY COLLABORATION

DOE: OASCR; HEP NSF: CISE; EPP CERN; EU MORE...



+



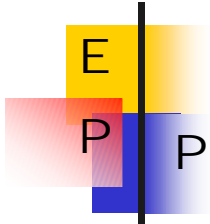
LHC and Global Infostructure
US Agreement on 5 Principles:

- n The cost and complexity of 21st Century **Science** requires the creation of advanced and coherent global "Infostructure"
- n The construction of a coherent **Global Infostructure for Science requires definition and drivers** from Global Applications (that will also communicate with each other)
- n Further, forefront Information Technology must be incorporated into this Global Infostructure for the Applications to reach their full potential for changing the way science is done.
- n **LHC is a near term Global Application requiring advanced and un-invented Infostructure and is ahead in planning compared to many others.**
- n U.S. agencies must work together for effective U.S. participation on Global scale infostructure, and the successful execution of the LHC program in a 4 way agency partnership, *with international cooperation in view.*

LHC RELATED GRID GLOSSARY

MAJOR ORGANIZATIONS

ATLAS/ CMS/ LHCb/ ALICE- LHC Experiments /Management
CERN Management
DOE/NSF
EU
More



PROJECTS:

LCG – LHC COMPUTING GRID PROJECT

§Operating Committees

§PEB-Project Execution Board

§GDB – Grid Deployment board

§Architects Forum

§High Level Committees

§POB – Project Oversight Board

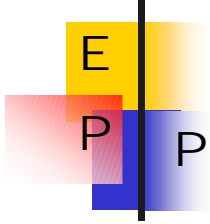
§SC2 – Software/Computing Requirements Board

§Computing Resources Review Board



TRILLIUM PROJECT (US)

- PPDG – Particle Physics Data Grid (DOE)
- GriPhyN – Grid Physics network (NSF)
- IVDGL – International Virtual Data Grid Laboratory (NSF)



MORE PROJECTS:

CrossGrid – mainly eastern European project, also Spain, Portugal, Ireland

DataTag– transatlantic grid – networking, interoperability

DTF – distributed Terascale facility – (NSF)

EDG – European Data grid project (EU funded)

GEANT- pan-European academic research network

GGF – Global grid forum (universal? grid organization)

GLOBUS-developing fundamental technologies needed to build computational grids.

GridPP – UK Grid project

HICB – High Energy Intergrid coordination board

HIJTB – High Energy Intergrid Joint Technical Board

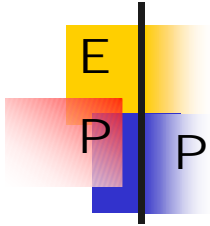
INFNGRID- Italian Grid Project

NCB – (ATLAS Experiment) National Computing Board

NorduGrid – Scandanavian grid project

(NB – while active, I'm not aware of a Japanese grid acronym)

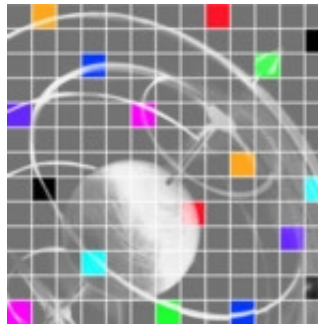
Meeting the MANAGEMENT CHALLENGE??



Plan for International Functional Demonstration Grids

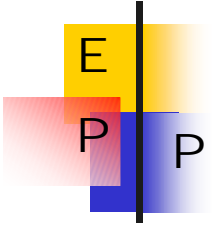
Definition

A series of functioning grids for use (now) by Trillium scientists, educators and others. Version zero in November designed to be used in X countries and handle Y data. Each succeeding version (~6 months) will multiply these numbers by $N \gg 1$.



With DOE

Features: Functional Demonstration Grids



Illustrates leadership in global grid development, told in ways designed to reach a large and important international audience.

Aligns project contributors and their products in a common cause.

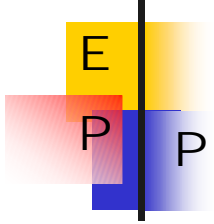
Allows broader audience (science/geology/biology) to be contributors/testers.

Serves as important milestones in getting the LHC “done.”

Provides real world tests of new concept functionality over ~20 year timeframe. .

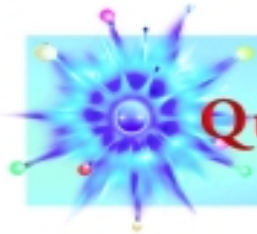
Points to what is needed next.

Thus is a very important management tool

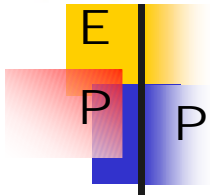


the adventure inherent in our
expedition must be accessible to
diverse audiences ..

Distributed Education/Outreach for Distributed Computing



QuarkNet LHC and EDUCATION OUTREACH NOW



Heller SPECIAL NSF/DOE Panel Review December 2001

Progress to date: Great

Best Practices: Yes

Teacher Satisfaction: High

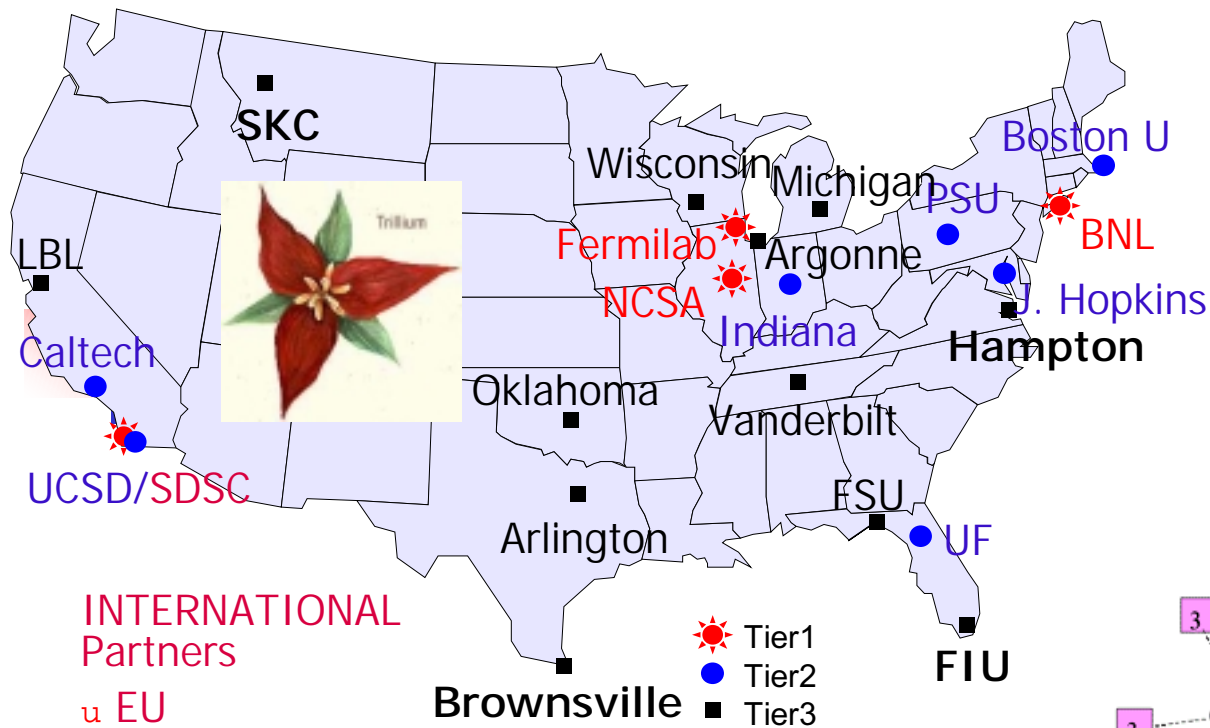
Benefits: Teachers are respected
and knowledgeable professionals.

Goals (excellent)

- Managed like EPP Experiment
- Through Teachers, Impacts 100,000 H.S. Students Each Year



MG HEPAP JULY 2003



INTERNATIONAL
Partners

- u EU
- u CERN
- u Brazil
- u Australia
- u Korea
- u Japan

MORE NEW PLANNING

Quarknet E/O
expands to teach
Quarks/Cosmos
and **Infostructure**

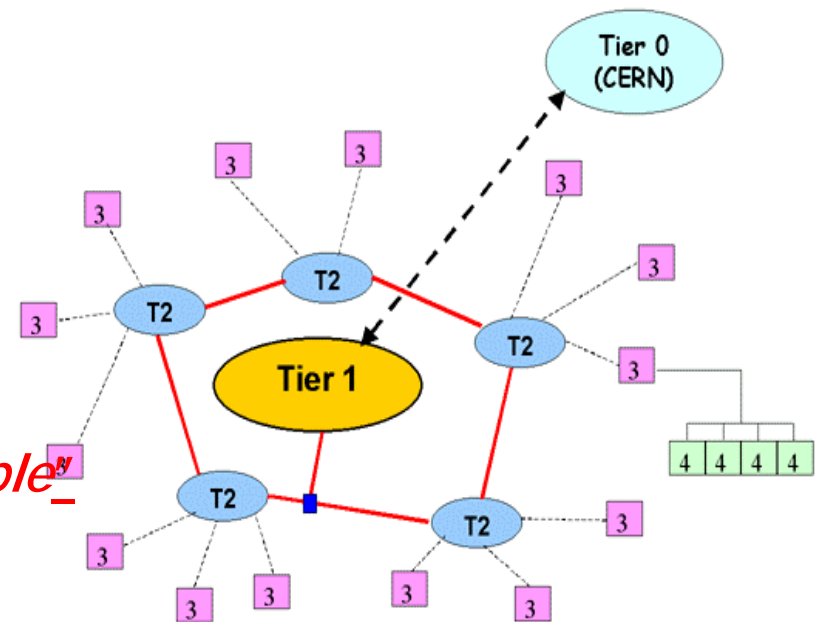
"Downloadable"



7/28/2003

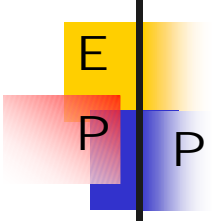
NEW PLANNING

Trillium Sites
Provide Grid
Infostructure to
Quarknet Sites





PLAN SUMMARY



Revolutionizing the way Global science is done through advanced cyberinfrastructure.

A basis for restructuring the integration of international research and education.

Empowering Universities in Research and Education

Empowering teachers as part of the research community

Bringing advanced cyberinfrastructure to the classroom by using distributed infrastructure supported for long times by Research Programs.

Closing Note

The expedition included a young Indian girl, who saved the explorers on numerous occasions, sometimes even from starvation, when she could find roots that nobody else knew about. To have Sacagawea say to them, "That's the Beaverhead, we're getting close to the Three Forks, we're on the right trail." All that lifted spirits when spirits were very low and they thought they'd never come to an end of this journey.

